The Effectiveness of Case-Based Learning to Improve the Collaboration and Communication Skills of Early Childhood Education Students

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Abstract

This study investigates the impact of case-based learning (CBL) on enhancing collaboration and communication skills among early childhood education (ECE) students. A meta-analysis was conducted using 25 effect sizes from studies published between 2022 and 2024, involving 1,056 participants and sourced from databases such as ERIC, ScienceDirect, Google Scholar, and Wiley. The JSAP application facilitated statistical analysis. Results indicate that CBL significantly outperforms conventional learning methods in fostering collaboration and communication, evidenced by a high summary effect size of 1.013. CBL offers an interactive, student-centered approach that places students in real-life scenarios, encouraging active participation, teamwork, and problem-solving skills. Through intensive group discussions and collaborative activities, students learn to articulate ideas, respect diverse perspectives, and engage constructively in group settings. These findings underscore CBL's potential as an effective pedagogical approach for developing essential interpersonal skills in ECE, which are critical for students' professional preparedness. Future studies should consider longitudinal impacts and cross-cultural contexts to validate these outcomes further.

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Introduction

Collaboration and communication have a very important role in early childhood education, as they both support a child's overall social, emotional, and cognitive development (Asnur et al., 2024). At an early age, children learn how to interact with peers and adults, which forms the foundation of their social skills in the future (Geçgil & Akçay, 2024; Alavi, 2024). The ability to collaborate helps children work together, share responsibilities, and understand the perspectives of others, which is essential for building a sense of empathy and tolerance (Jelatu et al., 2019). On the other hand, communication skills allow children to express ideas, needs,

and emotions in a healthy way, which in turn strengthens their interpersonal relationships. When children are able to communicate well, they also tend to have higher confidence in the learning environment (Kulak & Newton, 2015; Zhang et al., 2006).

In the context of early childhood education, collaboration and communication skills also play a role in facilitating group-based learning and interactive learning experiences. Learning methods such as role-playing, group discussions, and project-based activities allow children to practice collaborative and communicative skills in a fun and relevant way (Ali et al., 2018; Aduli et al., 2013). Through this interaction, children learn to listen to each other, appreciate differences, and actively participate in activities together. Over time, these skills not only support them in overcoming social and emotional challenges, but also become a strong foundation for the critical thinking and problem-solving skills they will need in their next level of education (Yang et al., 2023).

In the context of conventional learning, the importance of collaboration and communication skills is often underaccommodated. Traditional learning methods, which are generally one-way such as lectures or direct teaching, focus on delivering material by lecturers to students without much interaction or cooperation between students (Anazifa, 2016; Ichsan et al., 2023; Ali et al., 2024; Wantu et al., 2024). As a result, students tend to be passive, only receiving information, without the opportunity to hone active communication skills or the ability to work in a team. In fact, as previously described, collaboration and communication skills are very important to be learned and practiced since higher education so that students are ready to face the world of work that requires teamwork and good communication skills (Saputra et al., 2019); (Liline et al., 2024; Nurtamam et al., 2023; Hilmiyati et al., 2024). The absence of this collaborative and communicative aspect in conventional learning is one of the main obstacles in preparing students with qualified interpersonal skills (Fathonah et al., 2023; Agustina et al., 2024)

The limitations of this conventional method are increasingly seen when students are faced with challenges that require problem-solving skills in a team or situations that require effective interaction with others (Korkman & Metin, 2021). In the absence of learning that requires their active involvement in discussions and joint problem-solving, students often find it difficult to develop skills that will support them in communicating and working together (Amin et al., 2020); Zulyusri et al., 2023; Oktarina et al., 2021). With the lack of practice in an academic environment, students are less prepared when it comes to applying these skills in a real work environment (Zulkifli et al., 2022). Therefore, alternative learning approaches, such as Case-Based Learning (CBL), are important to implement. CBL provides students with the opportunity to actively participate in solving real cases, which involves intense interaction and collaboration, making it a more effective method of practicing collaboration and communication skills than conventional learning methods. Case based learning It is an effective learning model to encourage students' collaborative and communicative skills.

Case-Based Learning (CBL) is a learning method that puts students in the role of problem solvers, where they are faced with real cases that reflect life situations or the world of work (Yang et al., 2023). In CBL, students not only study theories, but are also required to apply them in concrete scenarios that require in-depth analysis, critical thinking, and sound decision-making (Malau-Aduli et al., 2013). This allows students to better understand the relevance of the material they are learning while honing their thinking skills in complex and dynamic situations. By focusing on a case-based approach, CBL not only enriches students' academic knowledge, but also equips them with practical skills that can be applied directly in the professional world (Zhao et al., 2020; Cen et al., 2021).

CBL is also very effective in building students' collaboration and communication skills. When working in groups to solve cases, students learn to actively discuss, listen to others' opinions, and collaborate to reach solutions together (McLean, 2016). Intensive discussion in CBL facilitates the development of interpersonal skills, such as articulating ideas clearly and accepting constructive criticism, which are difficult to obtain through conventional learning

methods (Fathonah et al., 2023). As such, CBL creates an interactive and student-centered learning environment, providing them with opportunities to develop essential social and professional skills. This makes CBL an effective method to prepare students to face the challenges of the world of work that require mature collaboration and communication skills.

The case based learning model is effective in improving creative and critical thinking skills in students (Arifin, 2020; Suwono et al., 2017); Agustina & Ro'isatin, 2024), activeness of the student learning process (Yang et al., 2024); activeness of the student learning process (Anazifa, 2016; Widyatiningtyas et al., 2015; Anazifa, 2016). However, there are many studies on Case Based Learning (CBL), but there has not been a single study related to the effect size model of cased based learning on the collaboration and communication skills of students in higher education. Therefore, a meta-analysis is needed to determine the influence of the Cased Based Learning (CBL) model on the collaboration and communication skills of students in higher education to find a comprehensive and in-depth understanding. Based on these things, this study aims to determine the effectiveness of case-based learning to improve the collaboration and communication skills of early childhood education students.

Methodology

This study uses a meta-analysis research method to determine the influence of effectiveness of case-based learning to improve the collaboration and communication skills of early childhood education students. Meta-analysis can provide a thorough evaluation through quantitative statistical analysis in a study (Tamur et al., 2020; Abdullah et al., 2024; Öztürk, 2023; Mackey et al., 2021; Miao et al., 2018). Effect size adalah besarnya ukuran pengaruh antar variabel yang akan diukur (Herdiansyah[1] & Putri[2], 2024; Badawi et al., 2023). The meta-analysis stages in this study are guided by (Borenstein et al., 2009) which consists of 1) determining an inclusion criterion; 2) collecting and encoding data and 3) statistical analysis in full can be seen in figure 1.
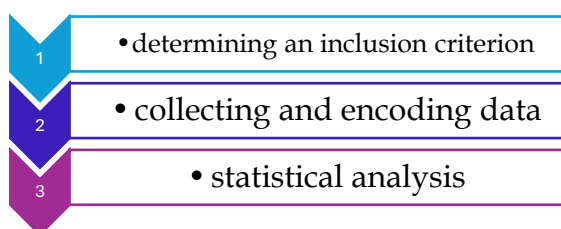

Figure 1. Meta-analysis Prosedure

Eligibility Criteria

In the process of searching for data through Google Scholar, ScienceDirect, Wiley, ERIC, ProQuest, Fronteins, and Web of Science databases, the research must meet several inclusion criteria 1) the research was published in 2022-2024; 2) research must be indexed by the Science Technology Index (SINTA) or Scopus; 3) research was obtained through the Google Scholar, Mendeley and ERIC databases; 4) The research must be relevant and report complete data to calculate the effect size value,. From the data search, 20 studies were obtained that met the inclusion criteria published in 2021-2024.

Data Collection

To obtain valid research data related to ethno-physics-based problem-based learning models to improve students' 21st-century thinking skills collected from ERIC, ScienceDirect, Google Scholar, and Wiley. The keywords for data search are "Cased Based Learning,": "Collaboration,";" The Effect of Cased Based Learning on Collaboration Ability,"; "The Effect of Cased Based Learning on Student Communication Skills,"; " The Influence of Cased Based Learning in Learning."

Statistical Analysis

Data analysis in this study calculates the effect size value of each study analyzed. The effect size value in this study is to calculate the effect of the effectiveness of case-based learning to improve the collaboration and communication skills of early childhood education students. Furthermore, the criteria for the effect size value in the study can be seen in Table 1.

Table 1. Category Effect Size Value

Effect Size	Category
Between -0.15 and 0.15	No Effect
Between 0.15 and 0.40	Low
Between 0.40 and 0.75	Moderate
Between 0.75 and 1.10	High
Between 1.10 and 1.45	Very High
1.45 or higher	Amazing

Source: (Borenstein et al., 2007; Bachtiar et al., 2023; Tamur et al., 2020); (Asnur et al., 2024; Oktarina et al., 2021)

Result and Discussion

Based on the results of data search through the database, 25 studies/articles met the inclusion criteria. The effect size and error standard can be seen in Table 2.

**Table 2. Effect Size and Standard Error Every Research**

Code Jurnal	Years	Effect Size	Variable	Standard Error
AT1	2022	0.71	Callaboration	0.22
AT2	2022	1.92	Callaboration	0.41
AT3	2022	0.66	Communicative	0.18
AT4	2023	0.89	Callaboration	0.30
AT5	2023	1.06	Callaboration	0.32
AT6	2023	1.35	Communicative	0.43
AT7	2023	0.78	Callaboration	0.27
AT8	2024	0.39	Communicative	0.19
AT9	2024	1.52	Communicative	0.42
AT10	2024	1.66	Callaboration	0.52
AT11	2024	2.07	Callaboration	0.62
AT12	2022	1.02	Communicative	0.38
AT13	2022	0.83	Callaboration	0.33
AT14	2023	0.62	Callaboration	0.20
AT15	2024	0.59	Communicative	0.20
AT16	2023	1.25	Communicative	0.39
AT17	2024	1.78	Communicative	0.40
AT18	2024	2.92	Communicative	0.52
AT19	2024	1.97	Communicative	0.40
AT20	2023	0.96	Communicative	0.37
AT21	2022	1.08	Callaboration	0.33
AT22	2022	0.77	Callaboration	0.26
AT23	2024	0.48	Communicative	0.19
AT24	2022	0.32	Communicative	0.11
AT 25	2023	0.92	Callaboration	0.30

Based on Table 2, the effect size value of the 25 studies ranged from 0.32 to 2.92. According to Borenstein et al., (2007) Of the 20 effect sizes, 2 penelitian nilai effect size kecil (8 %); 7 penelitian mmiliki nilai effect size sedang (28%), 3 penelitian mempunyai nilaii effect size tinggi (12%), 2 penelitian mempunyai nilai effect size sangat tinggi (8%) dan 11 penelitian mempunyai nilai effect size amazing (44 %).Furthermore, 25 studies were analyzed to determine an estimation model to calculate the mean effect size. The analysis of the fixed and random effect model estimation models can be seen in Table 3.

Table 3. Fixed and Random effect

	Q	df	p
Omnibus test of Coefficients Model	83.117	1	< 0.001
Test of Residual Heterogeneity	156.871	24	< 0.001

Based on Table 3, a Q value of 156,961 was obtained higher than the value of 83.117 with a coefficient interval of 95% and a p value of 0.001 <. The findings can be concluded that the value of 25 effect sizes analyzed is heterogeneously distributed. Therefore, the model used to calculate the mean effect size is a random effect model. Furthermore, checking publication bias through funnel plot analysis and Rosenthal fail safe N (FSN) test (Tamur et al., 2020; Badawi et al., 2022; Ichsan et al., 2023b; Borenstein et al., 2007; Noetel et al., 2021). The results of checking publication bias with funnel plot can be seen in Figure 2.
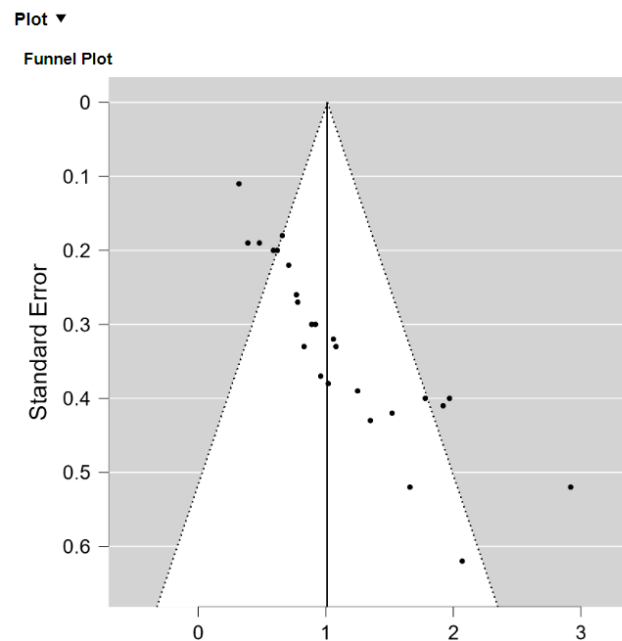
Figure 2. Funnel Plot

Based on Figure 2, the funnel plot analysis is not yet known whether it is symmetrical or asymmetrical, so it is necessary to conduct a Rosenthal Fail-Safe N (FSN) test. The results of the Rosenthal Fail Safe N calculation can be seen in Table 4.

Table 4. Fail Safe N Test

File Drawer Analysis			
	Fail Safe N	Target Significance	Observed Significance
Rosenthal	2513	0.050	< 0.001

Based on Table 4, the Fail Safe N value of 2513 is greater than the value of 5k + 10 = 5(25) + 10 = 135, so it can be concluded that the analysis of 25 effect sizes in this data is not biased by publication and can be scientifically accounted for. Next, calculate the p-value to test the hypothesis through the random effect model. The results of the summary effect model analysis with the random effect model can be seen in Table 5.

Tabel 5. Summary/ Mean Effect Size

Coeficient					Coeficient Interval 95%	
	Effect Size	Standard Error	z	p	Lower	Upper
Intercept	1.013	0.109	9.292	< 0.01	0.799	1.227

Based on table 5, it shows that there is a significant influence of Cased Based Learning on the collaboration and communication skills of students in higher education. This finding can be seen with a summary effect size value of 1,013; SE = 0.109 Z = 9.292 with 95% confidence and the lower limit of 0.799 and the upper limit of 1.227 with the high effect size category. The results concluded that the application of Cased Based Learning was effective in improving students' collaborative and communicative skills in higher education. Metode Case-Based Learning (CBL) is a learning approach that involves students in real-life situations or relevant cases, where they are encouraged to analyze, formulate solutions, and discuss their findings in an academic context (Jelatu et al., 2019). CBL is based on the principle that learning is more effective when students are actively involved in solving real-world problems. In the context of higher education, CBL not only aims to improve conceptual understanding, but also to build collaboration and communication skills that are essential for the professional world. With complex cases, students learn to share ideas, listen to other people's perspectives, and devise solutions collectively (Thistlethwaite et al., 2012; Ali et al., 2018).

CBL allows prospective educators to experience situations they might encounter in the real world, such as dealing with conflicts between children, managing group activities, or communicating effectively with parents and peers(McLean, 2016). Through CBL, students not only learn about theory, but also gain hands-on experience in practicing relevant skills, such as collaboration and communication, which are important in dealing with the various dynamics that occur in the early childhood classroom. With CBL, students are given the opportunity to work in groups to analyze, discuss, and complete case studies(Yang et al., 2023; Huang, 2023). This approach encourages interaction and cooperation between group members, thus helping them understand the importance of role division, shared decision-making, and other interpersonal skills (Ichsan et al., 2023a). Through this experience, students learn to respect the ideas and perspectives of others, which is crucial in creating a collaborative environment in the workplace later.

Furthermore, CBL, students are not only invited to discuss, but also to convey their ideas clearly and effectively. The situation in these cases often requires the ability to communicate appropriately and assertively (Zhao et al., 2020). Through the case discussion process, students can improve their speaking and listening skills actively, which is useful in their interactions with students and parents in the future. Effective communication skills enable aspiring educators to build positive relationships and provide a better learning impact (Amin et al., 2020; Alani, 2020). CBL has an advantage over traditional methods because it focuses on practice-based learning that is relevant to real-world situations. In the context of early childhood education, CBL provides situational simulations that can help students understand firsthand the challenges they may face in the classroom(Kantar & Massouh, 2015). This approach also helps them to learn to make quick and informed decisions in complex situations. By practicing through real-life cases, students not only develop collaboration and

communication skills, but also gain higher confidence in handling similar situations when they become educators in the future (Hatipoğlu, 2023).

The application of CBL in the early childhood education curriculum can have a positive impact on the development of prospective educators who not only understand theory, but also have the necessary practical skills in the field(Çam, 2009). By using CBL, students will be better prepared to face complex real-world situations, work closely with colleagues, and communicate effectively with various parties involved in children's education. This implication also opens up opportunities for educational institutions to develop more innovative and practice-oriented learning modules, which can make a significant contribution to improving the quality of early childhood education in the future (Bi et al., 2019).

Conclusion

From the results of the meta-analysis, it can be concluded that the effect size produced from the summary effect is 1,013 (high effect size). These findings show that, on average, students who use case-based learning can improve collaboration and communication skills in Early childhood education compared to conventional models. Through this model, students are invited to analyze and solve real cases or simulate situations that may be faced in the child's educational environment. For further research, it is recommended that a longitudinal study be conducted to assess the long-term impact of the application of case-based learning on the development of collaboration and communication skills in early childhood. In addition, research can expand the variables studied, such as the impact of this method on children's critical thinking skills and creativity. Research can also be conducted in different cultural contexts to see how cultural differences affect the effectiveness of these methods in improving children's social skills.

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References

Abdullah, A., Wijayanti, A., Suryono, W., Ika, M., Sarnoto, A. Z., Hiola, S. F., Ruchiat, A., Sari, W. D., & Santosa, T. A. (2024). Qualitative Study : Comparison of Implementation of The Effectiveness of the Ethno-Religious-Based SAVI Model in Improving Problem-Solving Skills in PAI Learning. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, *8*(5), 1245–1256. https://doi.org/10.31004/obsesi.v8i5.6192

Agustina, L., & Ro'isatin, U. A. (2024). The Efficacy of Case-Based Learning Model Integrated with Critical Thinking Skills to Improve EFL Learners' Reading Comprehension. *Journal of Languages and Language Teaching*, *12*(3), 1443. https://doi.org/10.33394/jollt.v12i3.11619

Agustina, R. D., Putra, R. P., & Listiawati, M. (2024). Collaborative Learning Based on Sophisticated Thinking Laboratory (Stb-Lab) and Gather Town As Gamification Tool for Blended Laboratory on Science Undergraduate Students. *Journal on Efficiency and Responsibility in Education and Science*, *17*(1), 67–78. https://doi.org/10.7160/eriesj.2024.170106

Alani, F. (2020). Development of case-based learning (CBL) in engineering technology education. *International Journal of Engineering Education*, *36*(3), 896–900.

Alavi, M. (1994). Computer-mediated collaborative learning: An empirical evaluation. *MIS Quarterly: Management Information Systems*, *18*(2), 159–174. https://doi.org/10.2307/249763

Ali, M., Han, S. C., Bilal, H. S. M., Lee, S., Kang, M. J. Y., Kang, B. H., Razzaq, M. A., & Amin, M. B. (2018). iCBLS: An interactive case-based learning system for medical education.

International Journal of Medical Informatics, *109*(November 2017), 55–69. https://doi.org/10.1016/j.ijmedinf.2017.11.004

Ali, M., Nurhayati, R., Wantu, H. M., Amri, M., & Santosa, T. A. (2024). The Effectiveness of Jigsaw Model Based on Flipped Classroom to Improve Students ' Critical Thinking Ability in Islamic Religious Education Learning. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, *8*(5), 1069–1078. https://doi.org/10.31004/obsesi.v8i5.6190

Amin, S., Utaya, S., Bachri, S., Sumarmi, & Susilo, S. (2020). Effect of problem-based learning on critical thinking skills and environmental attitude. *Journal for the Education of Gifted Young Scientists*, *8*(2), 743–755. https://doi.org/10.17478/jegys.650344

Anazifa, R. D. (2016). The Effect of Problem- Based Learning on Critical Thinking Skills and Student Achievement. *Proceeding of 3rd International Conference on Research*, *May*, 43–48.

Arifin. (2020). The effect of problem based learning by cognitive style on critical thinking skills and student retention | Arifin | Journal of Technology and Science Education. *Jotse, 2020 – 10*, *10*(2), 271–281. http://www.jotse.org/index.php/jotse/article/view/790

Asnur, L., Jalinus, N., Faridah, A., Apra, T., Ambiyar, R. D., & Utami, F. (2024). *Video-blogs (Vlogs) -based Project : A Meta Analysis*. *14*(5), 1553–1557.

Badawi et al. (2023). Integration of Blended Learning and Project-Based Learning (BPjBL) on Achievement of Students' learning goals: A Meta-analysis study. *Pegem Journal of Education and Instruction*, *13*(4). https://doi.org/10.47750/pegegog.13.04.32

Bi, M., Zhao, Z., Yang, J., & Wang, Y. (2019). Comparison of case-based learning and traditional method in teaching postgraduate students of medical oncology. *Medical Teacher*, *41*(10), 1124–1128. https://doi.org/10.1080/0142159X.2019.1617414

Borenstein, M., Hedges, L., & Rothstein, H. (2007). *Introduction to Meta-Analysis*. www.Meta-Analysis.com

Çam, A. (2009). Effectiveness of Case-Based Learning Instruction on Students" Understanding of Solubility Equilibrium Concepts a Thesis Submitted To the Graduate School of Natural and Applied Sciences of Middle East Technical University. *Hacettepe Egitim Dergisi*, *44*, 97–108. Edy Nurtamam, M., Apra Santosa, T., Aprilisia, S., Rahman, A., & Suharyat, Y. (2023). Meta-analysis: The Effectiveness of Iot-Based Flipped Learning to Improve Students' Problem Solving Abilities. *Jurnal Edumaspul*, *7*(1), 2023–1492.

Fathonah, S., Cahyono, E., Iswari, R. S., Haryani, S., Sarwi, S., Lestari, N. H., & Kadarwati, S. (2023). Effects of multirepresentation-based creative problem-solving learning model on students' critical thinking and diet nutritional quality. *Journal of Turkish Science Education*, *20*(4), 669–694. https://doi.org/10.36681/tused.2023.038

Geçgil, T., & Akçay, H. (2024). Investigating the Effects of Different Model Based Inquiries on Students' Science Achievement, Scientific Process Skills and Motivation. *International Journal of Education in Mathematics, Science and Technology*, *12*(3), 707–724. https://doi.org/10.46328/ijemst.3997

Hatipoğlu, C. (2023). The effect of a problem-based learning model on high school students' human values. *African Educational Research Journal*, *11*(2), 157–169. https://doi.org/10.30918/aerj.112.23.020

Herdiansyah[1], H., & Putri[2], P. K. (2024). The Influence of Interpersonal Communication Skills, Self-Efficacy, and Public Perception Towards the Glass Ceiling Phenomenon. *Eduvest-Journal of Universal Studies*, *4*(2), 435–447.

Hilmiyati, F., Panggabean, T. E., Khoirunnisa, R. N., Siregar, M. S., & Santosa, T. A. (2024). The Effectiveness of the CIPP Evaluation Model in Science Learning in the Era of the Industrial Revolution 4 . 0. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, *8*(6), 1375–1384. https://doi.org/10.31004/obsesi.v8i6.6227

Huang, J. H. (2023). The Effectiveness of Collaborative Learning on Developing Communicative Strategies in English for Specific Purpose Tour Guide Language Training Course at Tertiary Level. *International Journal of Educational Methodology*, *9*(4), 619–630. https://doi.org/10.12973/ijem.9.4.619

Ichsan, I., Suharyat, Y., Santosa, T. A., & Satria, E. (2023a). Effectiveness of STEM-Based Learning in Teaching 21 st Century Skills in Generation Z Student in Science Learning: A Meta-Analysis. *Jurnal Penelitian Pendidikan IPA*, *9*(1), 150–166. https://doi.org/10.29303/jppipa.v9i1.2517

Ichsan, I., Suharyat, Y., Santosa, T. A., & Satria, E. (2023b). Effectiveness of STEM-Based Learning in Teaching 21 st Century Skills in Generation Z Student in Science Learning: A Meta-Analysis. *Jurnal Penelitian Pendidikan IPA*, *9*(1), 150–166. https://doi.org/10.29303/jppipa.v9i1.2517

Jelatu, S., Kurniawan, Y., Kurnila, V. S., Mandur, K., & Jundu, R. (2019). Collaboration TPS learning model and m-Learning based on android for understanding of trigonometry concepts with different cognitive style. *International Journal of Instruction*, *12*(4), 545–560. https://doi.org/10.29333/iji.2019.12435a

Kantar, L. D., & Massouh, A. (2015). Case-based learning: What traditional curricula fail to teach. *Nurse Education Today*, *35*(8), e8–e14. https://doi.org/10.1016/j.nedt.2015.03.010

Korkman, N., & Metin, M. (2021). The Effect of Inquiry-Based Collaborative Learning and Inquiry-Based Online Collaborative Learning on Success and Permanent Learning of Students. *J.Sci.Learn*, *2021*(2), 151–159. https://doi.org/10.17509/jsl.v4i2.29038

Kulak, V., & Newton, G. (2015). An Investigation of the Pedagogical Impact of Using Case-based Learning in a Undergraduate Biochemistry Course. *International Journal of Higher Education*, *4*(4), 13–24. https://doi.org/10.5430/ijhe.v4n4p13

Liline, S., Tomhisa, A., Rumahlatu, D., & Sangur, K. (2024). The Effect of the Pjb-HOTS learning model on cognitive learning, analytical thinking skills, creative thinking skills, and metacognitive skills of biology education students. *Journal of Turkish Science Education*, *21*(1), 175–195. https://doi.org/10.36681/tused.2024.010

Mackey, J. D., McAllister, C. P., Ellen, B. P., & Carson, J. E. (2021). A Meta-Analysis of Interpersonal and Organizational Workplace Deviance Research. *Journal of Management*, *47*(3), 597–622. https://doi.org/10.1177/0149206319862612

Malau-Aduli, B. S., Lee, A. Y. S., Cooling, N., Catchpole, M., Jose, M., & Turner, R. (2013). Retention of knowledge and perceived relevance of basic sciences in an integrated case-based learning (CBL) curriculum. *BMC Medical Education*, *13*(1). https://doi.org/10.1186/1472-6920-13-139

McLean, S. F. (2016). Case-Based Learning and its Application in Medical and Health-Care Fields: A Review of Worldwide Literature. *Journal of Medical Education and Curricular Development*, *3*, JMECD.S20377. https://doi.org/10.4137/jmecd.s20377

Miao, C., Humphrey, R. H., & Qian, S. (2018). A cross-cultural meta-analysis of how leader emotional intelligence influences subordinate task performance and organizational citizenship behavior. *Journal of World Business*, *53*(4), 463–474. https://doi.org/10.1016/j.jwb.2018.01.003

Noetel, M., Griffith, S., Delaney, O., Sanders, T., Parker, P., del Pozo Cruz, B., & Lonsdale, C. (2021). Video Improves Learning in Higher Education: A Systematic Review. In *Review of Educational Research* (Vol. 91, Issue 2). https://doi.org/10.3102/0034654321990713

Oktarina, K., Suhaimi, Santosa, T. A., Razak, A., Irdawati, Ahda, Y., Lufri, & Putri, D. H. (2021). Meta-Analysis: The Effectiveness of Using Blended Learning on Multiple Intelligences and Student Character Education During the Covid-19 Period. *International Journal of Education and Curriculum Application*, *4*(3), 184–192. http://journal.ummat.ac.id/index.php/IJECA/article/view/5505

Öztürk, B. (2023). The Effect of Cooperative Learning Models on Learning Outcomes: A Second-Order Meta-Analysis. *Educational Policy Analysis and Strategic Research*, *18*(3), 273–296. https://doi.org/10.29329/epasr.2023.600.13

Saputra, M. D., Joyoatmojo, S., Wardani, D. K., & Sangka, K. B. (2019). Developing critical-thinking skills through the collaboration of Jigsaw model with problem-based learning model. *International Journal of Instruction*, *12*(1), 1077–1094.

https://doi.org/10.29333/iji.2019.12169a

Suwono, H., Pratiwi, H. E., Susanto, H., & Susilo, H. (2017). Enhancement of students' biological literacy and critical thinking of biology through socio-biological case-based learning. *Jurnal Pendidikan IPA Indonesia*, *6*(2), 213–222. https://doi.org/10.15294/jpii.v6i2.9622

Tamur, M., Juandi, D., & Kusumah, Y. S. (2020). The effectiveness of the application of mathematical software in indonesia; a meta-analysis study. *International Journal of Instruction*, *13*(4), 867–884. https://doi.org/10.29333/iji.2020.13453a

Thistlethwaite, J. E., Davies, D., Ekeocha, S., Kidd, J. M., MacDougall, C., Matthews, P., Purkis, J., & Clay, D. (2012). The effectiveness of case-based learning in health professional education. A BEME systematic review: BEME Guide No. 23. *Medical Teacher*, *34*(6), 142–159. https://doi.org/10.3109/0142159X.2012.680939

Wantu, H. M., Muis, A., Zain, A., Hiola, S. F., Agustina, I., Santosa, T. A., Yastanti, U., & Nugraha, A. R. (2024). Effectiveness of Think-Pair-Share and STEM Models on Critical Thinking in Early Childhood Education. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, *8*(5), 1320–1330. https://doi.org/10.31004/obsesi.v8i5.6202

Widyatiningtyas, R., Kusumah, Y. S., Sumarmo, U., & Sabandar, J. (2015). The impact of problem-based learning approach tosenior high school students' mathematics critical thinking ability. *Journal on Mathematics Education*, *6*(2), 30–38. https://doi.org/10.22342/jme.6.2.2165.107-116

X. Y. Cen, Y. Hua, S. Niu, & T. Yu. (2021). Application of case-based learning in medical student education: a meta-analysis. *European Review for Medical and Pharmacological Sciences*, *25*, 3173–3181.

Yang, W., Li, H., Su, A., & Ding, L. (2023). Application of problem based learning (PBL) and case based learning (CBL) in the teaching of international classification of diseases encoding. *Scientific Reports*, *13*(1), 1–9. https://doi.org/10.1038/s41598-023-42175-1

Yang, W., Zhang, X., Chen, X., Lu, J., & Tian, F. (2024). Based case based learning and flipped classroom as a means to improve international students' active learning and critical thinking ability. *BMC Medical Education*, *24*(1), 1–8. https://doi.org/10.1186/s12909-024-05758-8

Youna Chatrine Bachtiar, Mohammad Edy Nurtamam, Tomi Apra Santosa, Unan Yasmaniar Oktiawati, & Abdul Rahman. (2023). the Effect of Problem Based Learning Model Based on React Approach on Students' 21St Century Skills: Meta-Analysis. *International Journal of Educational Review, Law And Social Sciences (IJERLAS)*, *3*(5), 1576–1589. https://doi.org/10.54443/ijerlas.v3i5.1047

Zhang, D., Zhou, L., Briggs, R. O., & Nunamaker, J. F. (2006). Instructional video in e-learning: Assessing the impact of interactive video on learning effectiveness. *Information and Management*, *43*(1), 15–27. https://doi.org/10.1016/j.im.2005.01.004

Zhao, W., He, L., Deng, W., Zhu, J., Su, A., & Zhang, Y. (2020). The effectiveness of the combined problem-based learning (PBL) and case-based learning (CBL) teaching method in the clinical practical teaching of thyroid disease. *BMC Medical Education*, *20*(1), 1–10. https://doi.org/10.1186/s12909-020-02306-y

Zulkifli, Z., Satria, E., Supriyadi, A., & Santosa, T. A. (2022). Meta-analysis: The effectiveness of the integrated STEM technology pedagogical content knowledge learning model on the 21st century skills of high school students in the science department. *Psychology, Evaluation, and Technology in Educational Research*, *5*(1), 32–42. https://doi.org/10.33292/petier.v5i1.144

Zulyusri, Z., Santosa, T. A., Festiyed, F., Yerimadesi, Y., Yohandri, Y., Razak, A., & Sofianora, A. (2023). Effectiveness of STEM Learning Based on Design Thinking in Improving Critical Thinking Skills in Science Learning: A Meta-Analysis. *Jurnal Penelitian Pendidikan IPA*, *9*(6), 112–119. https://doi.org/10.29303/jppipa.v9i6.3709